GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 2

BARLEY

CHAPTER 2

BARLEY

Tables/Charts

2.1 GENERAL INFORMATION

a. All quantities referenced in this chapter are approximate unless otherwise specified.

b. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.

c. If an approved mechanical shaker is unavailable, inspectors may hand sieve the sample. When hand sieving, hold the sieve level in both hands with elbows close to the sides. In a steady motion, move the sieve from left to right approximately 10 inches and then return from right to left. Repeat this motion 30 times.

d. For specific visual reference images, see Chapter 1, section 1.2, Visual Grading Aids.

e. Official personnel shall document inspection information during sampling and grading. See book IV, chapter 2.

The inspection process provides various factor information used to determine grade and to provide further information on the condition or quality of barley. Each section of this chapter provides details on recording factor information. If requested by the applicant for inspection, additional information may be provided (e.g., an exact count on stones in addition to the percentage by weight, a percentage for a specific type of damage, etc.).

2.2 GRADES AND GRADE REQUIREMENTS

There are two classes of barley: Malting barley and Barley. Malting barley is divided into three subclasses: Six-rowed Malting barley, Six-rowed Blue Malting barley, and Two-rowed Malting barley. Barley is divided into three subclasses: Six-rowed barley, Two-rowed barley, and Barley.

All subclasses of Malting barley are divided into four numerical grades. All subclasses of Barley are divided into five numerical grades and U.S. Sample Grade. Special grades are provided to emphasize special qualities or conditions affecting the value of barley and are added to and made a part of the grade designation. They do not affect the numerical or sample grade designation.

TABLE NO. 1 – GRADES AND GRADE REQUIREMENTS – SIX-ROWED MALTING BARLEY AND SIX-ROWED BLUE MALTING BARLEY

	Minimum Limits of -			Maximum Limits of -				
Grade	Test weight per bushel (pounds)	Suitable malting type (percent)	Sound barley 1/ (percent)	Damaged kernels 1/ (percent)	Foreign material (percent)	Other grains (percent)	Skinned and broken kernels (percent)	Thin barley * (percent)
U.S. No. 1	47.0	95.0	97.0	2.0	0.5	2.0	4.0	7.0
U.S. No. 2	45.0	95.0	94.0	3.0	1.0	3.0	6.0	10.0
U.S. No. 3	43.0	95.0	90.0	4.0	2.0	5.0	8.0	15.0
U.S. No. 4	43.0	95.0	87.0	5.0	3.0	5.0	10.0	15.0

1/ Injured-by-frost kernels and injured-by-mold kernels are not considered damaged kernels or considered against sound barley.

NOTES: Malting barley shall not be infested, blighted, ergoty, garlicky, smutty, or contain any special grades. Upon request, malting barley varieties may be inspected and graded in accordance with standards established for the class Barley.

Six-rowed Malting and Six-rowed Blue Malting barley that does not meet the requirements for U.S. Nos. 1, 2, 3, or 4 Malting shall be graded under the Barley standards (see table 3).

* Use the 5/64 x 3/4 slotted-hole sieve.

TABLE NO. 2 - GRADES AND GRADE REQUIREMENTS - TWO-ROWED MALTING BARLEY

	Minimum Limits of -			Maximum Limits of -			
Grade	Test weight per bushel (pounds)	Suitable malting types (percent)	Sound barley 1/ (percent)	Wild Oats (percent)	Foreign material (percent)	Skinned and broken kernels (percent)	Thin barley * (percent)
U.S. No. 1	50.0	97.0	98.0	1.0	0.5	5.0	5.0
U.S. No. 2	48.0	97.0	98.0	1.0	1.0	7.0	7.0
U.S. No. 3	48.0	95.0	96.0	2.0	2.0	10.0	10.0
U.S. No. 4	48.0	95.0	93.0	3.0	3.0	10.0	10.0

1/ Injured-by-frost kernels and injured-by-mold kernels are not considered damaged kernels or considered against sound barley.

NOTES: Malting barley shall not be infested, blighted, ergoty, garlicky, smutty, or contain any special grades. Upon request, malting barley varieties may be inspected and graded in accordance with standards established for the class Barley.

Two-rowed Malting barley that does not meet the requirements for U.S. Nos. 1, 2, 3, or 4 Malting shall be graded under the Barley standards (see table 3).

* Use the 5.5/64 x 3/4 slotted-hole sieve.

TABLE NO. 3 - GRADES AND GRADE REQUIREMENTS - BARLEY

Grade	Minimum Limits of -		Maximum Limits of -				
	Test weight per bushel (pounds)	Sound barley (percent)	Damaged kernels 1/ (percent)	Heat damaged kernels (percent)	Foreign material (percent)	Broken kernels (percent)	Thin barley * (percent)
U.S. No. 1	47.0	97.0	2.0	0.2	1.0	4.0	10.0
U.S. No. 2	45.0	94.0	4.0	0.3	2.0	8.0	15.0
U.S. No. 3	43.0	90.0	6.0	0.5	3.0	12.0	25.0
U.S. No. 4	40.0	85.0	8.0	1.0	4.0	18.0	35.0
U.S. No. 5	36.0	75.0	10.0	3.0	5.0	28.0	75.0

U.S. Sample Grade:

U.S. Sample Grade shall be barley that:

(a) Does not meet the requirements for grades U.S. Nos. 1, 2, 3, 4, or 5; or

(b) Contains 8 or more stones or any number of stones which have an aggregate weight in excess of 0.2 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (Crotalaria spp.), 2 or more castor beans (Ricinus communis L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 8 or more cocklebur (Xanthium spp.) or similar seeds singly or in combination, 10 or more rodent pellets, bird droppings, or equivalent quantity of other animal filth per 1-1/8 to 1-1/4 quarts of barley; or

(c) Has a musty, sour, or commercially objectionable foreign odor (except smut or garlic odor); or

(d) Is heating or otherwise of distinctly low quality.

1/ Includes heat-damaged kernels. Injured-by-frost kernels and injured-by-mold kernels are not considered damaged kernels.

* Use the 5/64 x 3/4 slotted-hole sieve.

2.3 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in tables 1, 2, or 3. Use the following guidelines when assigning grades.

a. The letters "U.S.";

b. The abbreviation "No." and the number of the grade or the words "Sample Grade";

c. The words "or better" when applicable;

d. The name of the subclass;

e. The applicable special grade in alphabetical order;

f. The word "Dockage" and the percentage thereof; and

g. Upon request, the word "Plump" with the applicable percentage range.

For the subclass Barley, applicants may request that the percentage of each barley type (i.e., six- and two-rowed) in the mixture be shown in the "Remarks" section of the inspection certificate in order of predominance.

2.4 SPECIAL GRADES

Special grades draw attention to unusual conditions in the grain and are made part of the grade designation. The definitions and examples of the designations for special grades in barley are:

a. Blighted Barley. Barley that contains more than 4.0 percent of fungus-damaged and/or mold-damaged kernels.

Example: U.S. No. 4 Two-rowed Barley, Blighted, Dockage 0.5%

b. Ergoty Barley. Barley that contains more than 0.10 percent ergot.

Example: U.S. No. 3 Two-rowed Barley, Ergoty, Dockage 1.5%

c. Garlicky Barley. Barley that contains three or more green garlic bulblets, or an equivalent quantity of dry or partly dry bulblets in 500 grams of barley.

Example: U.S. No. 2 Six-rowed Barley, Garlicky

d. Infested Barley. Barley that is infested with live weevils or other live insects injurious to stored grain.

Example: U.S. No. 1 Barley, Infested

e. Smutty Barley. Barley that has kernels covered with smut spores to give a smutty appearance in mass, or which contains more than 0.20 percent smut balls.

Example: U.S. No. 3 Two-rowed Barley, Smutty

2.5 OPTIONAL GRADE DESIGNATION

The Official U.S. Standards for Grain provide an optional grade designation, commonly referred to as "or better." Upon request of the applicant, barley may be certified as U.S. No. 2 or better, U.S. No. 3 or better, etc. An "or better" grade designation cannot be applied to U.S. No. 1 grade designation.

The optional grade designation for barley shall include the name of the applicable subclass immediately preceding the word "barley" in the grade designation. When applicable, under certain conditions, include special grade designations and dockage in the certification.

Example: U.S. No. 2 or better Six-rowed Barley
U.S. No. 3 or better Six-rowed Barley, Dockage 1.5%

2.6 BASIS OF DETERMINATION

Distinctly Low Quality. The determination of distinctly low quality is made on the basis of the lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.

Certain Quality Determinations. Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburs, crotalaria seeds, dockage, garlic, live insect infestation, large stones, moisture, temperature, and unknown foreign substance(s), and a commonly recognized harmful or toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling according to procedures prescribed in FGIS instructions.

<u>All Other Determinations</u>. Each determination of heat-damaged kernels, injured-by-heat kernels, and white or blue aleurone layers in Six-rowed barley is made on pearled, dockage-free barley. Other determinations not specifically provided for under the General Provisions are made on the basis of the grain when free from dockage, except the determination of odor is made on either the basis of the grain as a whole or the grain when free from dockage.

TABLE NO. 4

BASIS OF DETERMINATION			
Lot as a Whole	Factors Determined Before the Removal of Dockage	Factors Determined on a Pearled Portion After the Removal of Dockage	Factors Determined After the Removal of Dockage
Distinctly low quality	Distinctly low quality	Blue aleurone layers	Blighted
Heating	Garlicky	Heat-damaged kernels	Broken kernels
Infested	Heating	Injured-by-heat	Class
Odor	Infested	Injured-by-sprout	Damaged kernels
	Kind of Grain	White aleurone layers	Ergot
	Moisture		Foreign material
	Odor		Frost-damaged
	U.S. Sample Grade factors		Injured-by-frost
			Injured-by-mold
			Mold-damaged
			Odor
			Other grains
			Plump barley
			Skinned and broken kernels
			Sound barley
			Smut
			Stones
			Subclass
			Test weight
			Thin barley
			Unsuitable malting type
			Wild oats

A general procedure based on the "Basis of Determination" definition is followed in the inspection and grading of barley. However, the procedure may vary according to the tests required to determine the grade. The following sections of this chapter are arranged in a logical sequence typically followed in the inspection and grading of barley.

2.7 DEFINITION OF BARLEY

Barley is defined as:

Grain that, before the removal of dockage, consists of 50 percent or more of whole kernels of cultivated barley (Hordeum vulgare L.) and not more than 25 percent of other grains for which standards have been established under the United States Grain Standards Act. The term "barley" as used in these standards shall not include hull-less barley or black barley.

Whole kernels are kernels with three-fourths or more of the kernel present. Other grains for which standards have been established are canola, corn, flaxseed, oats, rye, sorghum, soybeans, sunflower seed, triticale, and wheat.

Basis of Determination. Visually examine the sample to determine if it meets the definition of barley. If an analysis is necessary, make the determination before the removal of dockage on a portion of 25 grams.

If the sample does not meet the definition for barley, examine it further to determine if it is:

a. Another grain for which standards have been established or

b. Not standardized grain. No further analysis is necessary on a sample designated as not standardized grain unless a specific factor test is requested.

2.8 HEATING

Barley developing a high temperature from excessive respiration is considered heating. Advanced stage of heating barley will usually have a sour or musty odor. Care should be taken not to confuse barley that is heating with barley that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

Basis of Determination. Determine heating on evidence obtained at the time of sampling or on the basis of the sample as a whole.

Certification. Grade heating barley U.S. Sample Grade and record the word "Heating" on the work record and in the "Remarks" section of the certificate.

2.9 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling or on the sample either before or after the removal of dockage.

TABLE NO. 5

ODOR CLASSIFICATION EXAMPLES		
Sour	Musty	Commercially Objectionable Foreign Odors
Boot	Ground	Animal hides
Fermenting	Insect	Decaying animal and vegetable matter
Insect (acrid)	Moldy	Fertilizer
Pigpen		Fumigant
		Insecticide
		Oil products
		Skunk
		Smoke
		Strong weed

Commercially Objectionable Foreign Odors. Commercially objectionable foreign odors are odors, except smut and garlic odors, foreign to grain that render it unfit for normal commercial usage.

Fumigant or insecticide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of barley contains a fumigant or insecticide odor that prevents a determination as to whether any other odor(s) exists, apply the following guidelines:

a. Original Inspections. Allow the work portion to aerate in an open container for 4 hours, or less, if the odor dissipates in less time.

b. Reinspections, Appeal, and Board Appeal Inspections. Allow unworked file samples and new samples to aerate in an open container for 4 hours, or less, if the odor dissipates in less time. The 4-hour aeration requirement does not apply when the original work portion was aerated and retained as the final file.

Consider the sample as having a commercially objectionable foreign odor if the fumigant or insecticide odor persists based on the above criteria.

Final Determinations. The inspector(s) is responsible for making the final determination for all odors. A consensus of experienced inspectors is used, whenever possible, on samples containing marginal odors. The consensus approach is not required if no odor or a distinct odor is detected.

Certification. Grade barley containing a "distinct" musty, sour, or commercially objectionable foreign odor as U.S. Sample Grade. Record the words "Musty," "Sour," or "Commercially Objectionable Foreign Odor" in the "Remarks" section of the certificate.

2.10 MOISTURE

Water content in grain as determined by an approved device according to procedures prescribed in FGIS instructions.

Basis of Determination. Determine moisture before the removal of dockage on a portion of approximately 650 grams.

The procedures for performing a moisture determination using the GAC2500-UGMA and Perten AM 5200-A moisture meters are described in the Moisture Handbook.

For the class "Barley," select the predominating type (i.e., Six or Two-rowed) of barley in the mixture from the menu.

Certification. Record the percent of moisture on the work record and the certificate to the nearest tenth percent.

2.11 GARLICKY BARLEY

Barley that contains three or more green garlic bulblets or an equivalent quantity of dry or partly dry bulblets in a 500 grams of barley.

Basis of Determination. Determine garlicky before the removal of dockage on a work portion of 500 grams. (Reference: Visual Reference Image Nos. OF-Whole Garlic and OF-Dry Garlic Bulbs)

Characteristics of Bulblets.

a. Green garlic bulblets are bulblets which have retained all of their husks intact.

b. Dry or partly dry garlic bulblets are bulblets which have lost all or part of their husks. Consider bulblets with cracked husks as dry.

NOTE: Wild onion, sometimes referred to as "crow garlic", is considered as garlic.

Three dry or partly dry garlic bulblets are equal to one green bulblet.

Three or more green garlic bulblets or an equivalent of nine dry or partly dry bulblets in a 500-gram portion apply in the determination of the special grade "Garlicky."

Garlic bulblets apply in the determination of "Garlicky" but also function as dockage or foreign material as the case may be.

Certification. When applicable, grade the barley "Garlicky" in accordance with Section 2.4, Special Grades. Upon request, provide the number of garlic bulblets in whole and or in decimals to the hundredths position (e.g., 1/3 = 0.33, 2/3 = 0.67).

2.12 INFESTED BARLEY

Infested barley is barley that is infested with live weevils or other live insects injurious to stored grain.

The presence of any live weevil or other live insects injurious to stored grain found in the work sample indicates the probability of infestation and warns that the barley must be carefully examined to determine if it is infested. In such cases, examine the work sample and the file sample before reaching a conclusion as to whether or not the barley is infested. Do not examine the file sample if the work portion is insect free.

Live weevils include rice weevils, granary weevils, maize weevils, cowpea weevils, and lesser grain borers. Other live insects injurious to stored grain shall include grain beetles, grain moths, and larvae. (See Chapter 1, Section 1.2, Visual Grading Aids.)

Basis of Determination. Determine infestation on the lot as a whole and/or the sample as a whole. For insect tolerances, see table No. 6.

TABLE NO. 6

INSECT INFESTATION		
Samples meeting or exceeding any one of these tolerances are infested: ***2 lw, or 1 lw + 5 oli, or 10 oli***		
1,000-gram representative sample **1/** (+ file sample if needed)	Lot as a Whole (Stationary)	Online Sample (In-Motion) **2/**
Submitted samples Probed lots D/T sampled land carriers	Probed lots (at time of sampling)	Railcars under the Cu-sum Subsamples for Sacked Grain lots Components for Bargelots **3/** Components for Shiplots **3/**

1/ Examine work portion and file sample if necessary. Do not examine file sample if work portion is insect free.

2/ Minimum sampling rate is 500 grams per 2,000 bushels.

3/ Minimum component size is 10,000 bushels.

Key: lw = live weevil, oli = other live insects injurious to stored grain

Certification. When applicable, grade the barley "Infested" in accordance with Section 2.4, Special Grades.

2.13 DISTINCTLY LOW QUALITY

Consider barley distinctly low quality when it is obviously of inferior quality and the existing grade factors or guidelines do not properly reflect the inferior condition.

Basis of Determination. Use all available information to determine whether the barley is of distinctly low quality. This includes a general examination of the barley during sampling and an analysis of the obtained sample(s).

Large Debris. Barley containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler and too large to enter the sampling device is considered distinctly low quality.

Other Unusual Conditions. Barley that is obviously affected by other unusual conditions which adversely affect the quality of the barley and cannot be properly graded by use of the grading factors specified or defined in the standards is considered distinctly low quality.

Barley suspected of containing diatomaceous earth is considered distinctly low quality unless the applicant specifically requests an examination to verify the presence of diatomaceous earth. If the laboratory examination verifies that the barley contains diatomaceous earth, the barley is not considered distinctly low quality due to diatomaceous earth. Refer to Program Directive 9180.49, Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel, for additional information regarding the testing of barley for diatomaceous earth.

Certification. Grade distinctly low quality barley as U.S. Sample Grade. Record the words "Distinctly Low Quality" and the reason(s) why in the "Remarks" section of the certificate.

2.14 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine U.S. Sample Grade criteria, except for stones, before the removal of dockage based on a work portion of 850 - 950 grams. Determine stones on a dockage-free portion. The entire sample of a submitted sample is considered as the lot. Table No. 7 shows the criteria and corresponding visual reference images, tolerance limits, and the appropriate basis of determination. Consider feed pellets and processed grain products as foreign material not "unknown foreign substance." For Distinctly Low Quality, see section 2.13. (Reference: Visual Reference Images OF-Animal Filth, OF-Castor-Bean, OF-Cocklebur, OF-Crotalaria, and OF-Fertilizer)

TABLE NO. 7

U.S. SAMPLE GRADE CRITERIA			
	Visual Reference	Number/Weight **1/**	
Criteria	*Image*	*Sample Basis*	Lot Basis **2/**
Any numerical grading factor		Excess of limit for U.S. No. 5	N/A
Animal filth	OF-Animal Filth	10 or more	N/A
Castor Beans	OF-Castor Beans	2 or more	N/A
Cockleburs	OF-Cockleburs	8 or more	N/A
Crotalaria seeds	OF-Crotalaria	3 or more	N/A
Glass		2 or more	N/A
Odor		Presence	N/A
Stones		8 or more or any number in excess of 0.2% by weight	N/A
Unknown foreign substances **3/**	OF-Fertilizer	4 or more	N/A
Heating		Presence	Presence
Large Debris *		N/A	2 or more
Other unusual conditions *		Presence	Presence

1/ Record count factors to the nearest whole number.

2/ The entire sample of a submitted sample is considered as the lot.

3/ Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.

* For Distinctly Low Quality, see section 2.13

Certification. Grade barley U.S. Sample Grade when one or more of the limits in table 7 are observed. Record the reason(s) why in the "Remarks" section of the certificate. Record count factors to the nearest whole number.

2.15 DOCKAGE

All matter other than barley that can be removed from the original sample by use of an approved device according to procedures prescribed in FGIS instructions. Also, underdeveloped, shriveled, and small pieces of barley kernels removed in properly separating the material other than barley and that cannot be recovered by properly rescreening or recleaning.

Basis of Determination. Determine dockage on a portion of 850 - 950 grams.

CHART 1 - PROCEDURE FOR DETERMINING DOCKAGE

Carter Dockage Tester Setup

a. Set air control on 4 and the feed control on 6.

b. Insert No. 6 riddle in the riddle carriage.

c. Insert No. 8 sieve in the top sieve carriage.

d. Insert No. 6 sieve in the middle sieve carriage.

e. Start carter Dockage Tester and pour sample into feed hopper.

f. Aspirated material in air collection pan is dockage.

g. Material over No. 6 riddle, excluding barley, is dockage.

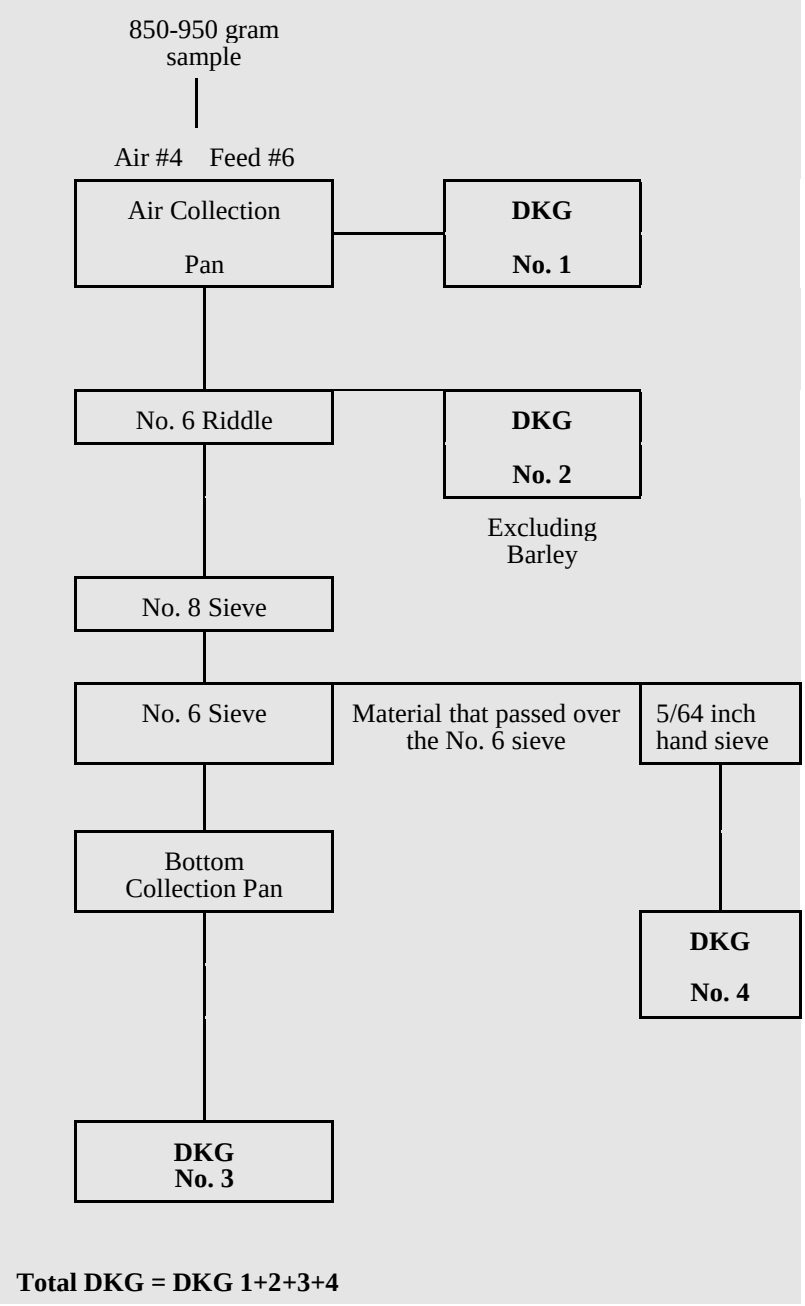
h. Material that passed through the No. 6 sieve (bottom collection pan) is dockage.

i. Examine material that passed over the No. 6 sieve to determine if it contains more than 0.1 percent of wild buckwheat, mustard seed, or similar seed. If so, this material must be rescreened using a 5/64 inch equilateral triangular hole sieve.

j. Place material that passed over the No. 6 sieve on the upper edge of the 5/64 inch sieve.

k. Hold the sieve at a 10-20° angle and work the material down over the sieve with a gentle side-to-side motion.

l. Return barley and other material remaining on top of the 5/64 inch sieve to the dockage-free sample. The material passing through the hand sieve is dockage.



Certification. Record the word "Dockage" and the percentage on the work record in hundredths and on the certificate in accordance with section 2.3, Grade Designations. When the sample contains 0.50 percent or more dockage, record the percentage of dockage on the certificate in half and whole percent with a fraction less than one-half percent disregarded. For example:

0.50 to 0.99 percent is recorded as 0.5 percent, etc.
1.00 to 1.49 percent is recorded as 1.0 percent, etc.

2.16 TEST WEIGHT

The weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device according to procedures prescribed in FGIS instructions.

Basis of Determination. Determine test weight on a dockage-free portion of sufficient quantity to overflow the kettle.

The procedures for performing a test weight determination and available services are described in book II, chapter 1, section 1.11.

Certification. Record test weight results on the work record as displayed on the electronic scale or in whole and half pounds. Disregard fractions of a half pound. Record the test weight on the certificate in whole and half pounds. If requested, convert the pounds per bushel (lbs./bu) result to kilograms per hectoliter (kg/hl) using the following formula: lbs./bu x 1.287 = kg/hl and record in the "Remarks" section in whole and tenths.

2.17 PROCESSING THE WORK SAMPLE

At this point, all tests required to be performed prior to the removal of dockage have been made and the percentage of dockage has been determined. Also, the sample has been test weighed and examined for certain sample grade and special grade factors. Now divide the work sample into fractional portions for other determinations required after the removal of dockage. The following chart and table No. 8 illustrate how the sample is divided into fractional parts using the Boerner divider.

CHART 2 - DIVIDING THE WORK SAMPLE

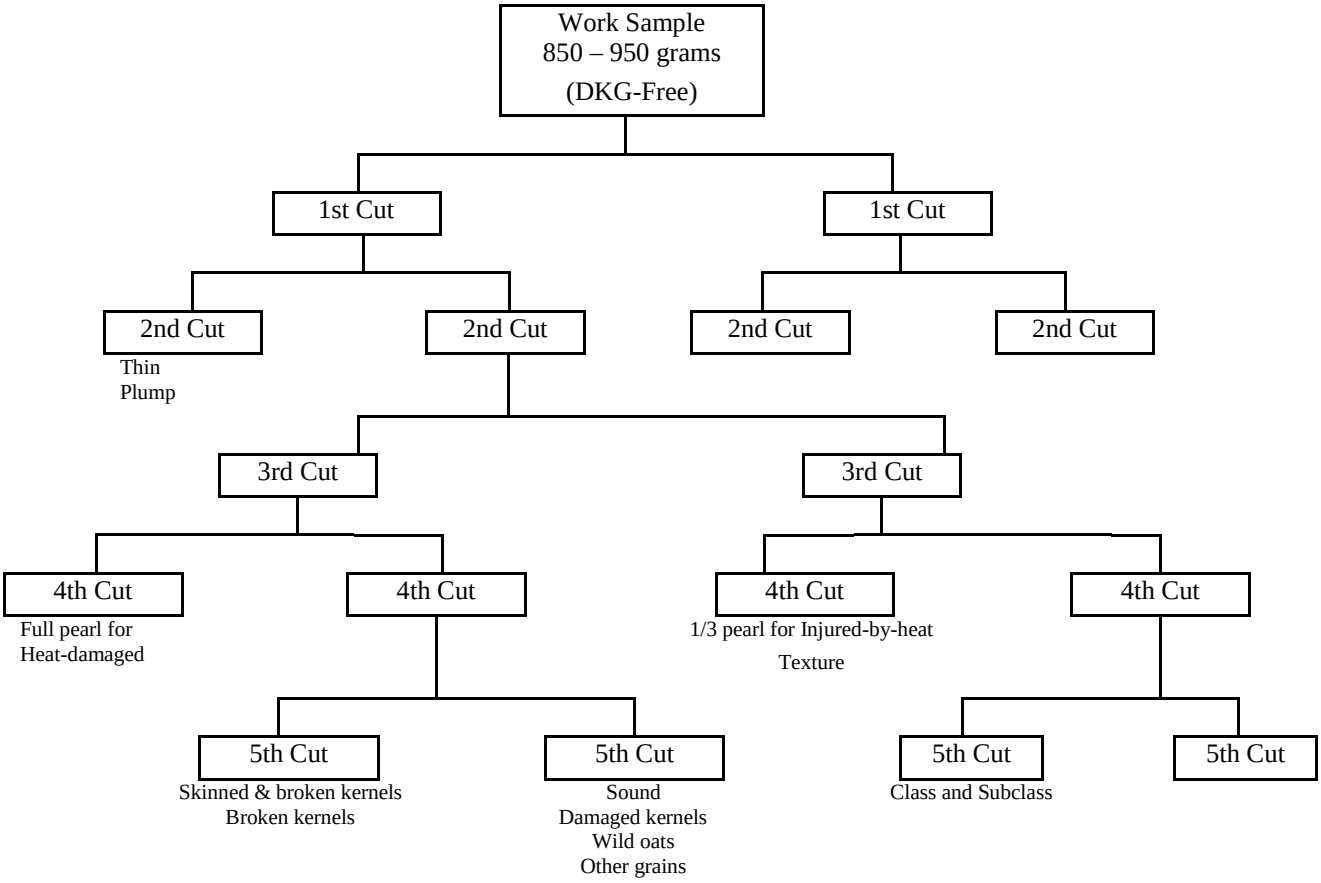


TABLE NO. 8

APPROXIMATE ANALYTICAL PORTION SIZES

Factors	*Grams*	*Factors*	*Grams*
Blighted	25	Injured-by-mold kernels	25
Broken kernels	25	Kernel texture	50
Class and subclass	25	Kind of grain 1/	25
Damaged kernels	25	Other grains	25
Ergot	250	Plump barley	250
Foreign material	25	Skinned & broken kernels	25
Garlic bulblets 1/	500	Smutty	500
Heat-damaged kernels	50	Sound barley	25
Injured-by-frost kernels	25	Thin barley	250
Injured-by-heat kernels	50	Wild oats	25

1/ Determined before the removal of dockage.

2.18 BLIGHTED BARLEY

Barley that contains more than 4.0 percent of fungus-damaged and/or mold-damaged kernels.

Basis of Determination. Determine blighted barley on a dockage-free portion of 25 grams. (Reference: Visual Reference Image No. B-1.0 Blight Damage)

Certification. When applicable, record the word "Blighted" on the certificate in accordance with Section 2.4, Special Grades.

2.19 ERGOTY BARLEY

Barley that contains more than 0.10 percent ergot.

Ergot is a hard, reddish-brown or black grain-like mass of certain parasitic fungi that replaces the kernels of barley. (Reference: Visual Reference Image No. OF-Ergot)

Basis of Determination. Determine ergot on a dockage-free portion of 250 grams. Ergot also functions as foreign material.

Certification. When applicable, record the word "Ergot" on the certificate in accordance with Section 2.4, Special Grades. Upon request, record the percentage of ergot to the nearest hundredth percent in the "Remarks" section of the certificate.

2.20 SMUTTY BARLEY

Barley that has kernels covered with smut spores to give a smutty appearance in mass, or which contains more than 0.20 percent smut balls.

Smut is a plant disease characterized by the appearance of smut balls or smut spores.

Basis of Determination. Determine the appearance of smutty barley on a dockage-free work portion. Determine the weight of smut balls on a dockage-free portion of 500 grams. Smut balls also function as foreign material.

Certification. When applicable, record the word "Smutty" on the certificate in accordance with Section 2.4, Special Grades. Upon request, record the percentage of smut balls to the nearest hundredth percent in the "Remarks" section of the certificate.

2.21 CLASS AND SUBCLASS

Barley is divided into two classes: Malting barley and Barley and each class is divided into three subclasses as follows:

a. *Malting Barley. Barley of the six-rowed or two-rowed malting type. The class Malting barley is divided into three subclasses:*

(1) *Six-rowed Malting Barley. Barley that has a minimum of 95.0 percent of a six-rowed suitable malting type that has 90.0 percent or more of kernels with white aleurone layers that contains not more than 1.9 percent injured-by-frost kernels, 0.4 percent frost-damaged kernels, 0.2 percent injured-by-heat kernels, and 0.1 percent heat-damaged kernels. Six-rowed Malting barley shall not be infested, blighted, ergoty, garlicky, or smutty as defined in § 810.107(b) and § 810.206.*

(2) *Six-rowed Blue Malting Barley. Barley that has a minimum of 95.0 percent of a six-rowed suitable malting type that has 90.0 percent or more of kernels with blue aleurone layers that contains not more than 1.9 percent injured-by-frost kernels, 0.4 percent frost-damaged kernels, 0.2 percent injured-by-heat kernels, and 0.1 percent heat-damaged kernels. Six-rowed Blue Malting barley shall not be infested, blighted, ergoty, garlicky, or smutty as defined in § 810.107(b) and § 810.206.*

(3) *Two-rowed Malting Barley. Barley that has a minimum of 95.0 percent of a two-rowed suitable malting type that contains not more than 1.9 percent injured-by-frost kernels, 0.4 percent frost-damaged kernels, 0.2 percent injured-by-heat kernels, 0.1 percent heat-damaged kernels, 1.9 percent injured-by-mold kernels, and 0.4 percent mold-damaged kernels. Two-rowed Malting barley shall not be infested, blighted, ergoty, garlicky, or smutty as defined in § 810.107(b) and § 810.206.*

b. *Barley. Any barley of six-rowed or two-rowed type. The class Barley is divided into the following three subclasses:*

(1) *Six-rowed Barley. Any six-rowed barley that contains not more than 10.0 percent two-rowed varieties.*

(2) *Two-rowed Barley. Any two-rowed barley with white hulls that contains not more than 10.0 percent six-rowed varieties.*

(3) *Barley. Any barley that does not meet the requirements for the subclasses Six-rowed barley or Two-rowed barley.*

Basis of Determination. Determine the class and subclass of barley by examining kernel and varietal characteristics on a dockage-free portion of 25 grams.

Two-rowed and Six-rowed Kernel Characteristics.

Two-rowed barley is usually characterized by plump symmetrical kernels with tight creases straight down the center of the kernels. Two-rowed barley often has a slightly wrinkled skin that is generally thinner than the skin of Six-rowed barley. (Reference: Visual Reference Image No. (B) OF-2.3 Two Rowed & Six Rowed)

The above characteristics vary somewhat with growing conditions but, as a whole, serve as an index of the differences between Two-rowed and Six-rowed barley.

Six-rowed barley is usually characterized by long, irregularly shaped kernels. The germs and creases in most Six-rowed barley kernels are twisted with the crease flaring open at the end of the kernel. Some kernels, however, have germs and creases which are straight. (Reference: Visual Reference Image No. (B) OF-2.3 Two Rowed & Six Rowed)

Two-rowed and Six-rowed Malting Varieties.

In addition to the determination of Two-rowed and Six-rowed kernel characteristics, the inspector must determine if the subclasses Six-rowed Malting barley, Six-rowed Blue Malting barley, and Two-rowed Malting barley contain sufficient quantities of suitable malting varieties.

The subclasses Six-rowed Malting barley and Six-rowed Blue Malting barley may contain no more than 5.0 percent of Two-rowed Malting barley or 5.0 percent of the class Barley.

The subclass Two-rowed Malting barley may contain not more than 3.0 percent of Six-rowed Malting barley or 3.0 percent of Two- or Six-rowed barley in grades U.S. Nos. 1 and 2, and not more than 5.0 percent of Six-rowed Malting barley or 5.0 percent of Two- or Six-rowed barley in grades U.S. No. 3 and 4.

Applicants for service may request either the malting standard (table Nos. 1 and 2) or the barley standards (table No. 3) for the class Malting barley.

Suitable Malting Type. In addition to varieties recommended by the American Malting Barley Association (AMBA), a malting grade designation may be applied to other malting varieties that meet quality requirements for malting. Refer to the AMBA website at.http.www.ambainc.org. for a current list of suitable malting varieties.

Certification. When barley is not of a suitable malting type (variety), record the words "Unsuitable Malting Type" on the work record and in the "Remarks" section of the certificate. When the applicant requests the application of the barley standards (table No.3) to a malting type barley, note this request on the work record but not on the certificate.

2.22 MALTING FACTORS

In addition to the grading factors listed in the grade and grade requirements tables (section 2.2), other limits have been established for malting barley. Factors, along with the grade factors listed in the tables, are determined before designating the class or subclass of barley. Upon request, malting factors may also be determined on barley that is not considered as a malting type.

TABLE NO. 9

MALTING FACTORS							
	Maximum limits of:						
Subclass	Frost Damage	Injured-by-Frost	Heat Damage	Injured-by-Heat	Mold Damage	Injured-by-Mold	Kernel Texture
Six-rowed Malting and Six-rowed Blue Malting	0.4%	1.9%	0.1%	0.2%	---	---	90%
Two-rowed Malting	0.4%	1.9%	0.1%	0.2%	0.4%	1.9%	---
Basis of Determination	25 g	25 g	50 g	50 g	25 g	25 g	50 g

Frost-Damaged and Injured-by-Frost Kernels.

Frost-Damaged Kernels. *Kernels, pieces of barley kernels, other grains, and wild oats that are badly shrunken and/or distinctly discolored black or brown by frost*. (Reference: Visual Reference Image No. B-3.1 Frost Damage)

Injured-by-Frost Kernels. *Kernels and pieces of barley kernels that are distinctly indented, immature or shrunken, or discolored to a light green in color as a result of frost before maturity*. (Reference: Visual Reference Image No. B-3.0 Injured-by-frost)

Basis of Determination. Determine frost damage and injured-by-frost on a dockage-free portion of 25 grams.

a. Frost-Damaged Kernel Limits.

(1) The class Malting barley may contain not more than 0.4 percent of frost-damaged kernels.

(2) Frost-damaged kernels are scored as damaged kernels and against sound barley limits.

b. Injured-by-Frost Kernel Limits.

(1) The class Malting barley may contain not more than 1.9 percent of injured-by-frost kernels that may include not more than 0.4 percent of frost-damaged kernels.

(2) Malting barley exceeding the limit for injured-by-frost kernels no longer qualifies as malting barley. Injured-by-frost kernels are not considered as damaged and are not scored against sound barley.

Certification. When malting barley exceeds the limits for "malting" because of frost-damaged kernels or injured-by-frost kernels, record the reason(s) on the work record and in the "Remarks" section of the certificate.

Heat-Damaged and Injured-by-Heat Kernels.

Heat-Damaged Kernels. *Kernels, pieces of barley kernels, other grains, and wild oats that are materially discolored and damaged by heat*. (Reference: Visual Reference Image No. B-5.1 Heat Damage)

Injured-by-Heat Kernels. *Kernels, pieces of barley kernels, other grains, and wild oats that are slightly discolored as a result of heat*. (Reference: Visual Reference Image No. B-5.Injured-by-Heat)

Basis of Determination. Determine injured-by-heat kernels and heat-damaged kernels on a dockage-free portion of 50 grams.

a. Determining Injured-by-Heat Kernels.

(1) Pour 50 grams of dockage-free barley into the barley pearler.

(2) Set the pearler timer for a "1/3 pearl."

(3) After pearling, reweigh and then examine the kernels for injured-by-heat.

(4) The class Malting barley may contain not more than 0.2 percent of injured-by-heat kernels.

b. Determining Heat-Damaged Kernels.

(1) Pour 50 grams of dockage-free barley into the barley pearler.

(2) Set the pearler timer for a "full standardized pearl."

(3) After pearling, reweigh and then examine the kernels for heat damage.

(4) The class Malting barley may contain not more than 0.1 percent of heat-damaged kernels.

Certification. When malting barley does not meet the malting requirements because it exceeds the limit for heat-damaged kernels and/or injured-by-heat kernels, record the reason(s) on the work record and in the "Remarks" section of the certificate.

See book II, chapter 1, section 1.14, for the general operating procedures of a barley pearler.

Mold-Damaged and Injured-by-Mold Kernels.

> Mold-Damaged Kernels. *Kernels, pieces of barley kernels, other grains, and wild oats that are weathered and contain considerable evidence of mold*.

Mold-damaged kernels are characterized by black or grayish spots or blotches on one or both sides of the kernel. (Reference: Visual Reference Image No. B-1.1 Mold Damage)

> Injured-by-Mold Kernels. *Kernels, pieces of barley kernels containing slight evidence of mold*.

The quality factor injured-by-mold applies to Two-rowed Malting barley only. Injured-by-mold kernels are characterized by mold spores and have a weathered appearance. (Reference: Visual Reference Image No. B-7.0 Injured-by-Mold)

Basis of Determination. Determine mold-damaged kernels and injured-by-mold kernels on a dockage-free portion of 25 grams.

a. Mold-Damaged Kernel Limits.

(1) The subclass Two-rowed Malting barley may contain not more than 0.4 percent of mold-damaged kernels.

(2) Mold-damaged kernels in Six-rowed Malting barley and Six-rowed Blue Malting barley are scored as damaged kernels and against sound barley limits.

b. Injured-by-Mold Kernel Limits.

(1) The subclass Two-rowed Malting barley may contain not more than 1.9 percent of injured-by-mold kernels that may include not more than 0.4 percent of mold-damaged kernels.

(2) Two-rowed Malting barley exceeding the limit for injured-by-mold kernels no longer qualifies as malting barley. Injured-by-mold kernels are not considered as damaged and are not scored against sound barley.

Certification. When malting barley does not meet the requirements for malting because it exceeds the limits for malting because of mold-damaged kernels or injured-by-mold kernels, record the reason(s) why on the work record and in the "Remarks" section of the certificate.

Kernel Texture.

Basis of Determination. Determine kernel texture on a dockage-free portion of 50 grams.

Method of Determination.

a. Pour a 50-gram portion into the pearler.

b. Set the timer for a "1/3 pearl" and turn pearler on.

c. After pearling, reweigh and then examine the kernels for texture.

Six-rowed Malting Barley.

Six-rowed Malting barley consists of 90.0 percent or more of kernels with white aleurone layers.

Six-rowed Blue Malting Barley.

Six-rowed Blue Malting barley consists of 90.0 percent or more of kernels with blue aleurone layers.

Do not consider foreign material, other grains, or wild oats when determining kernels with white or blue aleurone layers.

Certification. When barley is not considered "malting" because of white or blue aleurone layers, record the reason(s) why on the work record and in the "Remarks" section of the certificate.

2.23 PLUMP BARLEY

Plump barley is barley that remains on top of a 6/64 x 3/4 inch slotted-hole sieve after sieving according to procedures prescribed in FGIS instructions.

"Plump" is determined only upon request. Any barley may qualify for plump.

Basis of Determination. Determine plump on a dockage-free portion of 250 grams.

Methods of Determination.

a. Mechanical Sieving Method.

(1) Mount the sieve and bottom pan on the mechanical sieve shaker.

(2) Set the stroke counter for 30 strokes.

(3) Follow the procedure described in Book II, Chapter 1, Section 1.13, Mechanical Sieve Shaker.

(4) Return the material lodged in the perforations to the barley which remained on top of the sieve.

(5) All material remaining on top of the sieve is "plump" barley.

b. Hand Sieving Method.

(1) Mount the sieve on a bottom pan.

(2) Place the 250-gram portion in the center of the sieve.

(3) Hold the sieve level in both hands with elbows close to the sides and the sieve perforations parallel to the direction of movement.

(4) In a steady motion, move the sieve from left to right approximately 10 inches and then from right to left.

(5) Repeat this operation 30 times.

(6) Return the material lodged in the perforations to the barley which remained on top of the sieve.

(7) All material remaining on top of the sieve is "plump" barley.

Certification. When requested, record the actual percentage of plump barley on the work record. Show the word "Plump" and the applicable percentage range in the "Remarks" section of the certificate. Percentage ranges are recorded as: Below 50 percent, 50 to 55 percent, 56 to 60 percent, 61 to 65 percent, etc. Upon request, "Plump" barley may be certificated to the nearest whole percent in conjunction with the applicable range statement.

2.24 THIN BARLEY

Thin barley shall be defined for the appropriate class as follows:

a. *Malting Barley. Six-rowed Malting barley that passes through a 5/64 x 3/4 slotted-hole sieve and Two-rowed Malting barley that passes through a 5.5/64 x 3/4 slotted-hold sieve in accordance with procedures prescribed in GIPSAs instructions.*

b. *Barley. Six-rowed barley, Two-rowed barley, or Barley that passes through a 5/64 x 3/4 slotted-hole sieve in accordance with procedures prescribed in GIPSAs instructions.*

Basis of Determination. Determine thin barley on a dockage-free portion of 250 grams. Use either the mechanical sieving method or the hand sieving method to determine thin. Return all material lodged in the perforations of the sieve to the barley remaining on top of the sieve. The procedures for using either of these methods are described in section 2.23.

Certification. Record the percentage of thin barley on the work record and the certificate to the nearest tenth percent.

2.25 SKINNED AND BROKEN KERNELS

Barley kernels that have one-third or more of the hull removed, or that the hull is loose or missing over the germ, or broken kernels, or whole kernels that have a part or all of the germ missing.

Basis of Determination. Determine skinned and broken kernels on a dockage-free portion of 25 grams.

Skinned and broken kernels is a grade determining factor in the subclasses Six-rowed Malting barley, Six-rowed Blue Malting barley, and Two-rowed Malting barley. (Reference: Visual Reference Image No. (B)OF-2.1 Skinned Broken)

Certification. When malting barley does not meet the requirements for malting because it exceeds the limit for skinned and broken kernels, record the percentage of skinned and broken kernels on the work record and in the "Remarks" section of the certificate to the nearest tenth percent.

2.26 SOUND BARLEY

Kernels and pieces of barley kernels that are not damaged.

Basis of Determination. Determine sound barley on a dockage-free portion of 25 grams.

Sound barley includes:

a. Skinned and broken kernels of barley which are not damaged,

b. Broken kernels which are not damaged,

c. Green immature kernels of barley not otherwise damaged, and

d. Kernels which are considered injured-by-frost and/or injured-by-mold.

Sound barley does not include damaged kernels of barley and material other than barley.

The sum of the percentages of damaged kernels, foreign material, other grains, and wild oats subtracted from 100 percent, equals the percentage of sound barley.

Certification. Record the percentage of sound barley on the work record and the certificate to the nearest tenth percent.

2.27 DAMAGED KERNELS

Kernels, pieces of barley kernels, other grains, and wild oats that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, injured-by-heat, insect-bored, mold-damaged, sprout-damaged, or otherwise materially damaged.

Basis of Determination. Determine damaged kernels on a dockage-free portion of 25 grams.

The factor damaged kernels is a grade determining factor in the subclasses Six-rowed Malting barley, Six-rowed Blue Malting barley, Six-rowed barley, Two-rowed barley, and the class Barley. Damaged kernels are not considered as sound in any class or subclass of barley.

In general, kernels of barley, other grains, or wild oats are considered damaged for inspection and grading purposes only when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes.

TYPES OF BARLEY DAMAGE.

Blight-Damaged Kernels. Kernels and pieces of barley kernels which are covered by at least one-third or more of blight. Blight discolorations should not be confused with badly stained, weathered, or water-stained kernels. Designate barley containing more than 4.0 percent of blight-damaged kernels as "Blighted" (see section 2.18). (Reference: Visual Reference Image No. B-1.0 Blight Damage)

Malt-Damaged Kernels. Kernels and pieces of barley kernels which have undergone the malting process and show any degree of sprout.

Frost-Damaged Kernels. Kernels and pieces of barley kernels that are badly shrunken and/or distinctly discolored black, brown, or green by frost. (Reference: Visual Reference Image No. B-3.1 Frost Damage)

Mold-Damaged Kernels. Kernels and pieces of barley kernels that are weathered and contain considerable evidence of mold. Mold-damaged kernels are characterized by black or grayish spots or blotches on one or both sides of the kernel. Designate barley that contains more than 4.0 percent of mold-damaged kernels as "Blighted" (see section 2.18.) (Reference: Visual Reference Image No. B-1.1 Mold Damage)

Germ-Damaged Kernels (Sick and/or Mold). Kernels, pieces of barley kernels that have dead or discolored germ ends. Germ-damaged kernels are kernels and pieces of barley kernels in which the germ is discolored by heat or mold as a result of respiration. This includes barley injured-by-heat. (Reference: Visual Reference Image No. B-4.0 Germ Damage)

Heat-Damaged Kernels. Kernels, pieces of barley kernels, other grains, and wild oats that are materially discolored and damaged by heat. The determination for heat-damaged kernels is made on a 50-gram pearled portion. (See section 2.22) (Reference: Visual Reference Image No. B-5.1 Heat Damage)

Weevil or Insect-Bored. Weevil or insect-bored barley is kernels and pieces of barley kernels which have been bored or tunneled by insects. (Reference: Visual Reference Image No. B-6.0 Weevil or Insect Bored)

Mold-like Substance. Mold-like substance is whole kernels of barley which are 50 percent or more covered and pieces of kernels which are discolored and covered with a mold-like substance.

Sprout-Damaged Kernels. Kernels and pieces of barley kernels which have sprouted or which have swelling over the germ and after examination show sprout. (Reference: Visual Reference Image No. B-8.0 Sprout Damage)

Certification. Record the percent of damaged kernels on the work record and the certificate to the nearest tenth percent.

2.28 FOREIGN MATERIAL

All matter other than barley, other grains, and wild oats that remains in the sample after the removal of dockage.

Basis of Determination. Determine foreign material on a dockage-free portion of 25 grams.

Certification. Record the percent of foreign material on the work record and the certificate to the nearest tenth percent.

2.29 WILD OATS

Seeds of Avena fatua L. and A. sterilis L.

Basis of Determination. Determine wild oats on a dockage-free portion of 25 grams.

Wild Oats Characteristics. Wild oats are usually identified by their slender kernels and twisted awns--so called "sucker mouths"--and basal hairs or bristles on the germ end of the kernel. (Reference: Visual Reference Image No. OF- Wild Oats)

Wild oats are a grade determining factor only in the subclass Two-rowed Malting barley. Wild oats are deducted from the percentage of sound barley in all other classes and subclasses of barley.

Certification. When applicable, record the percentage of wild oats on the work record and the certificate to the nearest tenth percent.

2.30 BROKEN KERNELS

Broken kernels are barley kernels with more than 1/4 of the kernel removed.

Basis of Determination. Determine broken kernels on a dockage-free portion of 25 grams.

Broken kernels are a grade determining factor in the class Barley.

Certification. When applicable, record the percent of broken kernels on the work record and the certificate to the nearest tenth percent.

2.31 OTHER GRAINS

Black barley, canola, corn, cultivated buckwheat, einkorn, emmer, flaxseed, guar, hull-less barley, hull-less oats, nongrain sorghum, oat groats, oats, Polish wheat, popcorn, poulard wheat, rice, rye, safflower, sorghum, soybeans, spelt, sunflower seed, sweet corn, triticale, and wheat.

Basis of Determination. Determine other grains on a dockage-free portion of 25 grams.

Other grains is a grading factor in the subclasses Six-rowed Malting barley and Six-rowed Blue Malting barley. Other grains are not considered as sound in all classes and subclasses of barley.

Certification. When applicable, record the percentage of other grains on the work record and the certificate to the nearest tenth percent.

2.32 OFFICIAL CRITERIA

"Injured-by-sprout" analysis is an "official criteria" factor that is determined only upon request and does not effect the grade designation. The factor "injured-by-sprout" is not considered as a grading factor and is provided for informational purposes only. Therefore, it is not included in "total damaged kernels" or scored against "sound barley" determinations.

Basis of Determination. The "injured-by-sprout" analysis shall be performed on the basis of a representative portion of approximately 55 grams (dockage-free) of barley that has been pearled with a "standardized" pearler. Standardized pearlers must be used in this procedure in order to achieve the appropriate amount of hull removal.

If a pearler has already been approved for official use, it is not necessary to re-standardize it. However, it is necessary to establish the "injured-by-sprout" pearling time for that particular pearler.

a. Determining "Injured-by-Sprout" Pearling Time.

(1) To calculate "injured-by-sprout" pearling time, multiply the standardized "full pearl" time by 1/5.

For example: If the established standardized pearling time for a particular FGIS-approved pearler is 90 seconds, the corresponding "injured-by-sprout" pearling time is calculated at 18 seconds (90 x 1/5).

Note: Actual "injured-by-sprout" pearling time may deviate by ± 1 second. Using the example above, the acceptable "injured-by-sprout" pearling time is between 17 and 19 seconds.

(2) Record the "injured-by-sprout" pearling time on or near the pearler for quick reference.

b. Determining Injured-by-Sprout Kernels.

(1) Pour 55 grams of dockage-free barley into the barley pearler.

(2) Set the pearler timer for a "1/5 pearl."

(3) After pearling, examine the kernels for injured-by-sprout. From the pearled portion, consider kernels meeting the following criteria as "injured-by-sprout."

Whole or broken kernels which contain a sprout or sprout socket or whole and broken kernels with ⅔ or more of the embryo (germ) missing. Do not include broken kernels in which the germ area has broken off and the remaining kernel is less than ⅔ of a whole kernel. (Reference: Visual Reference Image No. (B) O.F.-2.4 Injured by Sprout)

(4) Determine the percentage of "injured-by-sprout" kernels by weighing the "injured-by-sprout" kernels and dividing by the weight of the original (unpearled) analytical portion.

Certification. Record the percentage of "injured-by-sprout" kernels on the work record and the certificate to the nearest tenth percent. Results are certified in the "Remarks" section of the certificate with the following statement:

"This barley contains _____ percent of injured-by-sprout kernels."